THE QWEAK EXPERIMENT: A SEARCH FOR NEW PHYSICS AT THE TEV SCALE VIA A MEASUREMENT OF THE PROTON'S WEAK CHARGE

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The QWeak experiment at Jefferson laboratory was recently approved to challenge predictions of the Standard Model and search for new physics via a precision measurement of parity violating electron scattering on the proton at very low Q^2 and forward angles. A unique opportunity exists to carry out the first precision measurement of the proton's weak charge, $Q^p_W = 1 - 4\sin^2\Theta_W$, at JLab, building on technical advances that have been made in the laboratory's world-leading parity violation program and using the results of earlier experiments to constrain hadronic corrections. A 2200 hour measurement of the parity violating asymmetry in elastic ep scattering at $Q^2=0.03$ $(GeV/c)^2$ employing 180 μA of 80% polarized beam on a 35 cm liquid Hydrogen target will determine the proton's weak charge with 4% combined statistical and systematic errors. The Standard Model makes a firm prediction of Q^p_W, based on the running of the weak mixing angle $\sin^2\Theta_W$ from the Z0 pole down to low energies, corresponding to a 10 sigma effect in our experiment. Any significant deviation of $\sin^2\Theta_W$ from the Standard Model prediction at low Q^2 would be a signal of new physics, whereas agreement would place new and significant constraints on possible Standard Model extensions. In the absence of physics beyond the Standard Model, our experiment will provide a 0.3% measurement of $\sin^2\Theta_W$, making this a very competitive standalone measurement of the weak mixing angle.

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